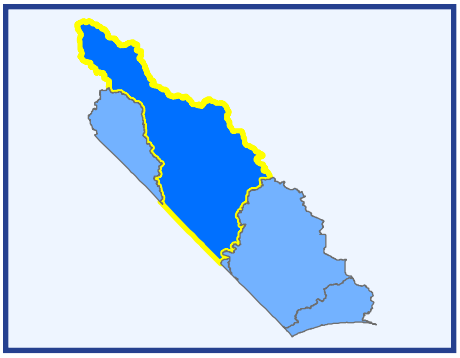


Chapter 2
Lumber River Subbasin

Part of Hydrologic Unit Code: 03040203

General Description

The Lumber River subbasin (Figure 2-1) encompasses about 1,631 square miles within North Carolina. The Lumber River headwaters are located in the sandhills of Hoke, Montgomery, Moore, Richmond, and Scotland Counties. The Robeson and Columbus County portions of the basin lie within the Inner Coastal Plain. All 115 miles of the Lumber River have been designated as a North Carolina Natural and Scenic River. In addition, 81 miles of the Lumber River are designated as a Federal Wild and Scenic River. These designations allow restrictions to be placed on dam construction and other water resource projects. The Lumber River State Park, created in 1989, currently protects 8,438 acres along the Lumber River, as well as, providing recreational opportunities. The Lumber River discharges to the Little Pee Dee River in South Carolina.

Current Status and Significant Issues

Population and Land Use

Population for this subbasin is estimated to be around 160,368 or 98 people per square mile based on the 2000 census. Lumberton, Pinehurst, and Southern Pines are currently the only municipalities with populations greater than 5,000. The municipalities of Aberdeen, Foxfire Village, Pinebluff, Pinehurst, and Southern Pines are the fastest growing areas and are all located in southern Moore County.

Agriculture dominates much of the land use at just over 30 percent; however, the headwaters have remained heavily forested. Close to a quarter of this subbasin is comprised of wooded wetlands found mainly in the floodplains of the braided river systems. Southern Moore County has a high concentration of golf courses and small lakes.

Ambient Water Quality

Nine Ambient Monitoring System sites were maintained in the Lumber River subbasin during the assessment period. Iron was the only parameter tested that exceeeded the water quality standards more than 10 percent of the time at these stations. These waterbodies were not impaired for iron because it was determined that this is the natural condition. During the drought of 2002, conductivity was high at all ambient monitoring sites on the Lumber River, except for the most upstream sampling location. Readings have since returned to normal.

Watershed at a Glance

COUNTIES

Bladen, Columbus, Hoke, Montgomery, Moore, Richmond, Robeson, Scotland

MUNICIPALITIES

Aberdeen, Bladenboro, Boardman, Candor, Cerro Gordo, Chadbourn, Dublin, Fair Bluff, Fairmont, Foxfire Village, Hoffman, Lumber Bridge, Lumberton, Marietta, Maxton, McDonald, Norman, Orrum, Parkton, Pembroke, Pineblugg, Pinehurst, Proctorville, Raeford, Raynham, Red Springs, Rennert, Rowland, Saint Pauls, Southern Pines, Tar Heel, Wagram

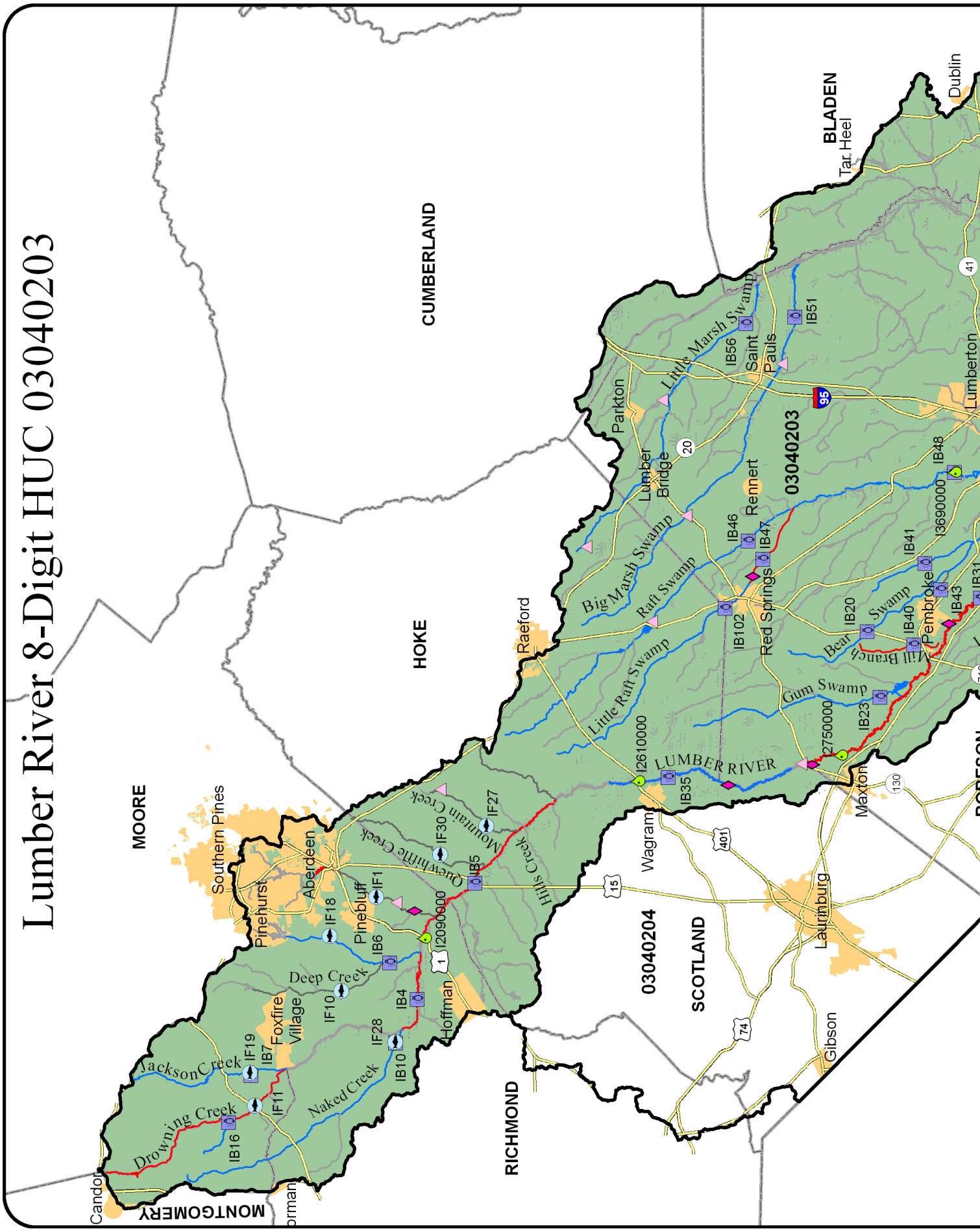
PERMITTED FACILITIES

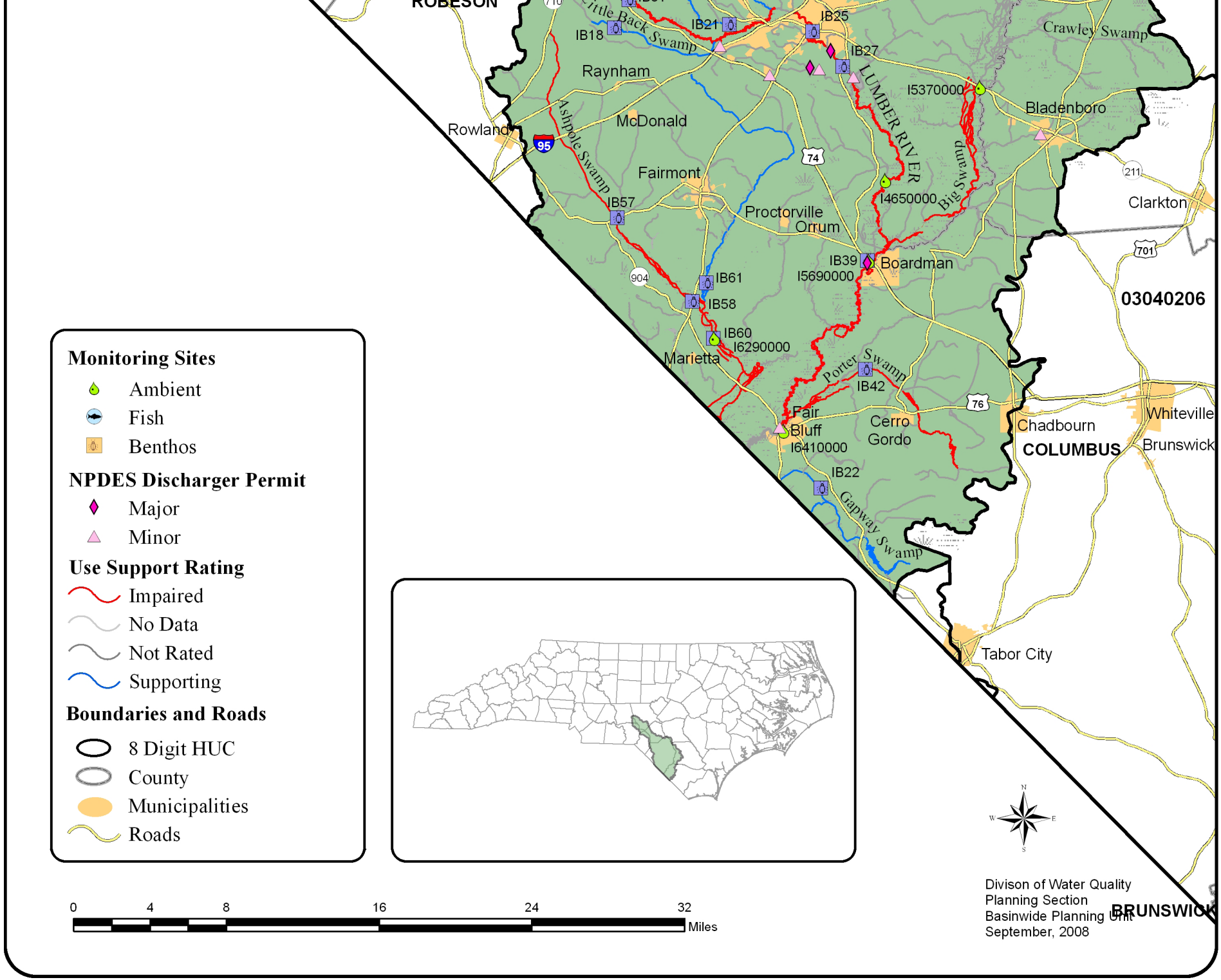
NPDES Discharge	
Major:	8
Minor:	14
NPDES Nondischarge:	16
NPDES Stormwater	
General:	72
Individual:	5
State:	3
Animal Operations:	104

AQUATIC LIFE SUMMARY

Monitored:	423 Miles
	35 Acres
Total Supporting:	340 Miles
	0 Acres
Total Impaired:	31 Miles
	0 Acres
Total Not Rated:	53 Miles
	35 Acres

Figure 2-1: Lumber River Subbasin (03040203)

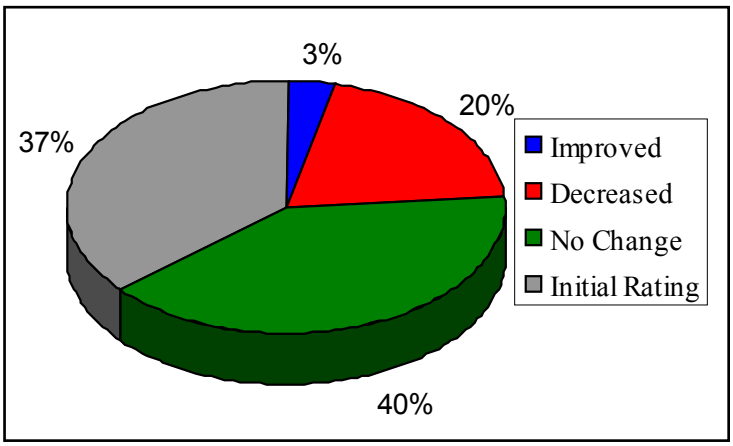



ROBESON
IB18
IB21
IB25
IB27
Little Back Swamp
Crawley Swamp
Raynham
LUMBER RIVER
I5370000
Bladenboro
McDonald
Rowland
Ashpole Swamp
Big Swamp
Fairmont
I4650000
Clarkton
IB57
Proctorville
Orrum
IB39
Boardman
I5690000
03040206
IB61
IB58
IB60
I6290000
Marietta
Porter Swamp
IB42
Fair
Bluff
I6410000
Cerro
Gordo
Chadbourn
COLUMBUS
Whiteville
Brunswick
IB22
Gapway Swamp
Tabor City
BRUNSWICK
Monitoring Sites
Ambient
Fish
Benthos
NPDES Discharger Permit
Major
Minor
Use Support Rating
Impaired
No Data
Not Rated
Supporting
Boundaries and Roads
8 Digit HUC
County
Municipalities
Roads
0
4
8
16
24
32
Miles
Divison of Water Quality
Planning Section
Basinwide Planning Unit
September, 2008

General Biological Health

A total of 33 benthic macroinvertebrate samples from 30 benthic sites were analyzed during the assessment period. There were three stations added to the five-year biological assessment cycle in 2006, plus seven more stations received their first rating as part of special studies. Only one benthic macroinvertebrate sampling site in this subbasin showed an improvement, while six indicated a decline (Figure 2-2). Three locations declined enough to warrant an impaired aquatic life rating. These sampling sites were located on Little Raft Swamp AU# 14-10-5b, Mill Branch AU# 14-6, and Porter Swamp AU# 14-27. Fish communities in the watershed were healthy and only one site reported the presence of a non-native species.

Figure 2-2: Change in Benthic Site Ratings



Local Water Quality

There are 12 whole and two partial watersheds (10-digit HUCs) in the North Carolina portion of the Lumber River subbasin made up of 58 subwatersheds (12-digit HUCs). In order to determine the source of a pollutant in a watershed it is useful to break down a large drainage area into smaller areas. This approach also helps identify where monitoring and restoration is being conducted and where it is in need. Table 2-1 list the number of benthic and ambient monitoring sites that were sampled for the 2002-2006 assessment period by watersheds. Figure 2-3 shows the location of these watersheds and is labeled with the last two digits of the 10 digit HUC.

Table 2-1: Number of Benthic and Ambient Site in the Lumber River Subbasin by 10-Digit Watershed

10 - Digit HUC	Name	Square Miles	Benthic Sites	Ambient Sites
0304020301	Upper Drowning Creek	129.8	4	0
0304020302	Lower Drowning Creek	193.9	2	1
0304020303	Gum Swamp - Lumber River	94.0	2	2
0304020304	Bear Swamp - Lumber River	84.5	7	0
0304020305	Raft Swamp	168.7	4	1
0304020306	Gallberry Swamp	152.2	2	0
0304020307	Upper Big Swamp	116.1	0	0
0304020308	Middle Big Swamp	85.5	0	1
0304020309	Lower Big Swamp	90.3	0	0
0304020310	Saddletree Swamp	115.1	3	2
0304020311	Porter Swamp	133.9	1	1
0304020312	Ashpole Swamp Headwaters	202.2	4	1
0304020313	Ashpole Swamp	*18.5	0	0
0304020314	Lumber River Outlet	*46.0	1	0

*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

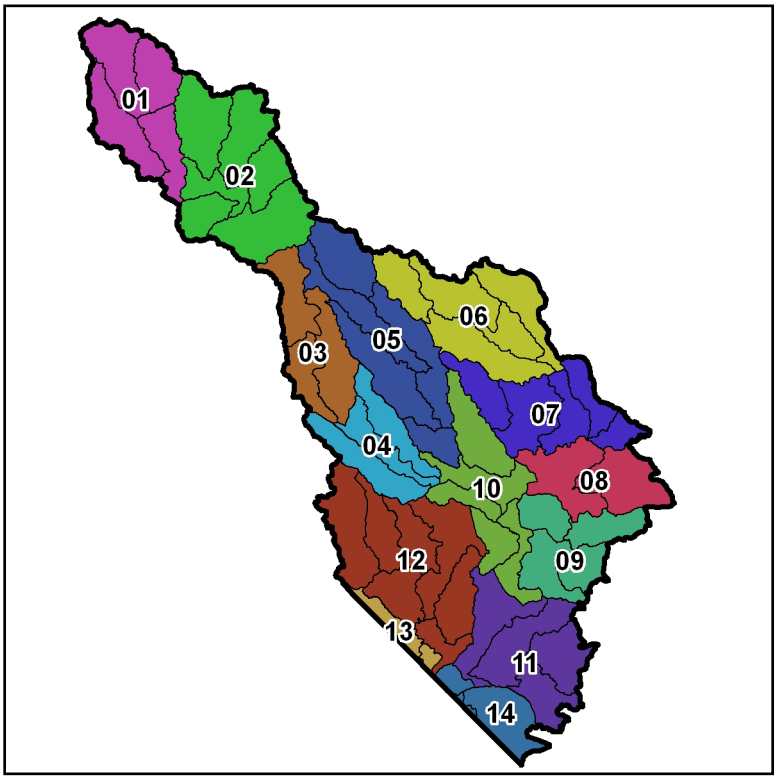
Upper Drowning Creek (0304020301)

All streams in this watershed are classified as Water Supply II and are supplementally classified as either a HQW or an ORW. Parts of Candor, Foxfire Village, and Hoffman are in this watershed (Figure 2-4). There are no permitted wastewater discharges but there are three permitted animal operations. It has four subwatersheds (12-Digit HUCs) .

Jackson Creek (030402030101)

Samples from benthic macroinvertebrate sampling site IB7, located on Jackson Creek AU # 14-2-5, produced many pollution intolerant taxa. One taxa collected here was not found at any other station in the Lumber Basin. The rating given to this location was Good and it was determined that the water quality condition here has remained steady.

Figure 2-3: 10 Digit HUCs in the Lumber Subbasin



Fish community sampling site IF19, at the same location as IB7, yielded typical results for fish communities in the sand hills ecoregion. Seventeen total species were found here which marks a slight improvement from 2001. The Dusky Shiner was the most common fish and two species of Special Concern the Sandhills Chub and Pinewoods Darter were present.

Lake Auman, created in 1979, is a 772 acre private man-made spring-fed lake with an earthen dam. The dam underwent repairs in 1996 and 2009 because its stability rating had dropped. DWQ does not monitor private lakes but volunteer monitors from Lake Auman have participated in the ***Great North American Secchi Dip-in***. This event, which is sponsored by the North American Lake Management Society and the Environmental Protection Agency, seeks to increase public interest in volunteer monitoring while gaining insight into lake water transparency across North America. Lake Auman has consistently been one of the clearest lakes tested.

Drowning Creek Headwaters (030402030102)

Fish community sampling site IF11, located at NC Highway 73 on Drowning Creek AU # 14-2-(1)a, resulted in the documentation of 20 total species. This stream segment had the greatest variety of any fish community sampled during the 2006 assessment. It also produced the only exotic species reported which was a Redlip Shiner. The Dusky Shiner was the most abundant species and two species of Special Concen, the Sandhills Chub and the Pinewoods Darter were both collected.

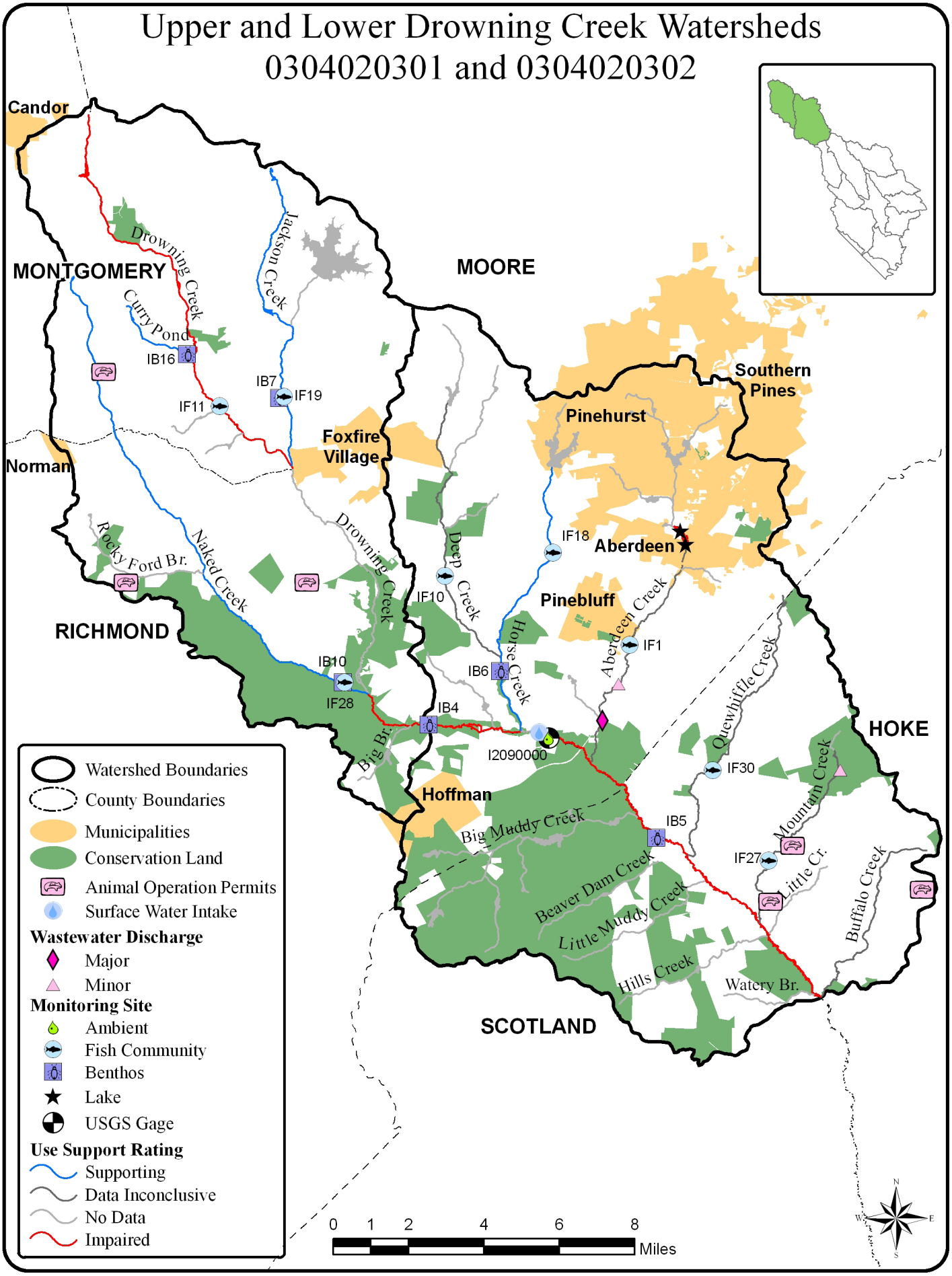
Naked Creek (030402030103)

Every waterbody in this entire subwatershed is supplementally classified as ORW including Naked Creek AU # 14-2-6 and Rocky Ford Branch AU # 14-2-6-1. In 2006, the Sand Hills Area Land Trust received a grant from the Clean Water Management Trust Fund (CWMTF) to purchase a 50.8 acre easement on Naked Creek. It was designated by the ***Ecosystem Enhancement Program*** (EEP) as a ***targeted local watershed*** (TLW) in 2008 due to the high level of assets and the existence of active local conservation groups.

Benthic macroinvertebrate sampling site IB10, located at State Road 1003 on Naked Creek AU # 14-2-6, continued a streak of 14 consecutive Excellent ratings dating back to 1983. The total number of taxa collected here was greater in 2006 than 2001 and six taxa were only collected here and nowhere else in the Lumber Basin. However, it was noted that one side of the creek lacked a riparian buffer.

Fish community sampling site IF28, in the same location as benthic macroinvertebrate station IB10, varied little from the other fish community sites within the Upper Drowning Creek Watershed. The number of different species collected here has increased since sampling first began 1996.

FIGURE 2-4: UPPER AND LOWER DROWNING CREEK WATERSHEDS (0304020301 AND 0304020302)



Big Branch-Upper Drowning Creek (030402030104)
Benthic macroinvertebrate sampling site IB4, located at State Road 1004 on Drowning Creek AU# 14-2-(6.5), is at the outlet for the Big Branch Watershed. This site received an Excellent bioclassification rating for every assessment since 1985. Many pollution intolerant species continue to inhabit this location and there are three species found here that were not found anywhere else in the Lumber Basin.

Lower Drowning Creek (0304020302)

Municipalities in Lower Drowning Creek watershed include part of Pinehurst, Southern Pines, Foxfire Village, Hoffman plus all of Aberdeen and Pinebluff (Figure 2-4). Also located here is the almost 8,000 acre Camp Mackall Military Reservation. There are one major and two minor NPDES discharge permits in the watershed with a total permitted flow of 6.7 MGD. This watershed has six subwatersheds.

Horse Creek (030402030201)
Fish community sampling site IF18, located at State Road 1112 on Horse Creek AU # 14-2-10b, approximately 2.7 miles downstream from Pinehurst Lake AU # 14-2-10a, was established as a new monitoring location during the 2006 field season. While this site was Not Rated it was reflective of the number and diversity of fish species typically found in a healthy sandhills stream. It received one of the highest habitat scores in the Lumber Basin with a 96 out of 100.

Further downstream at State Road 1102 on the same assessment unit (stream segment) of Horse Creek, benthic macroinvertebrate station IB6 was sampled in 2006. Many species previously noted at this site were absent; however, a high number of intolerant taxa contributed to an Excellent bioclassification rating. The pH at the time of sampling was 5.0 su, below the standard of 6.0 su, which may explain why some previously recorded taxa were absent from the samples. This was the only benthic macroinvertebrate sampling site to have its rating increase from 2001. The site rated Good in 2001 as the result of difficulties in sampling due to high flow conditions. Previous samples taken in 1991 and 1996 were also rated Excellent.

Fish community sampling site IF10, located at State Road 1113 on Deep Creek AU # 14-10-1-(2), was given a bioclassification of Not Rated. This site showed an improvement in the diversity of species and had a high habitat score of 96 out of 100. Like many fish community sites in the sandhills the most dominant species was the Dusky Shiner and both the Sandhill Chub and Pinewoods Darter, species of Special Concern, were present. The pH at the time of sampling was 4.8 su below the standard of 6.0 su.

Aberdeen Creek (030402030202)
This subwatershed is the most urbanized subwatershed in both Upper and Lower Drowning Creek Watersheds. It contains large portions of Aberdeen, Southern Pines, Pinehurst, and Pinebluff. Pages Lake AU # 14-2-11-(5) is a man-made lake built in the 1930's and is approximately 35 acres. This lake, which is located in Aberdeen, was sampled as part of the 2006 Lakes and Reservoir Assessment. The lake suffers from an overabundance of aquatic plants but is drained in the winter to control these aquatic weeds. It was treated for Hydrilla and Parrotfeather in 2009 as part of the Division of Water Resources Aquatic Weed Control Program.

Fish community sampling site IF1 is located at State Road 1105 on Aberdeen Creek AU # 14-2-1-(6) within Pinebluff. A lower number of total fish were collected at this site compared to other fish communities sampled in the sandhills but the sample was still fairly diverse with species. This was the only site sampled during the assessment period that did not contain the Sandhills Chub or the Pinewoods Darter; however they were not present in 2001 either.

Big Muddy Lake-Big Muddy Creek (030402030203)
There has not been any water quality data gathered from this subwatershed by DWQ. The Town of Hoffman and Camp MacKall Military Reservation are located here. Camp Mackall makes up about 37 percent of the

subwatershed and the Sandhills Game Land makes up another 47 percent of the subwatershed. The Sandhills Gameland is managed by the North Carolina Wildlife Resources Commission.

Middle Drowning Creek (030402030204)
Ambient monitoring station I2090000, located at US Highway 1 on Drowning Creek AU # 14-2-(10.5), exceeded the iron standard in 25 percent of the samples. Drowning Creek was not impaired for exceeding this standard because elevated levels of iron are normal for this area. There are no permitted dischargers upstream of this sampling point, which is near the water supply intake for the town of Southern Pines.

Quewhiffle Creek (030402030205)
Fish community sampling site IF30, located at State Road 1225 on Quewhiffle Creek AU # 14-2-14, had the fewest total number of specimens and the least amount of diversity. However, it was tied for the highest habitat score in the entire Lumber Basin with a score of 97 out of 100. It was also the only site where the Pinewoods Darter, a species of Special Concern, was the dominant species. This sample varied little from the sample taken at this site in 2001, so water quality does not seem to be in decline.

Lower Drowning Creek (030402030206)
Fish community sampling site IF27, located at State Road 1215 on Mountain Creek AU # 14-2-16-(2), decreased in diversity with the Dusky Shiner making up 91 percent of the fish community. However, the pollution intolerant Pinewoods Darter and Sandhills Chub were also present suggesting that overall the fish community is healthy. The habitat score given to this location was a 97 out of 100.

Gum Swamp-Lumber River (0304020303)

About one-third of this watershed is classified as a Water Supply IV watershed. There are two major and one minor NPDES discharge permits in the watershed with a total permitted flow of 4.31 MGD (Figure 2-5). There are 8 permitted animal operation located here and all but one are in the Gum Swamp subwatershed (030402030302). This watershed has three subwatersheds.

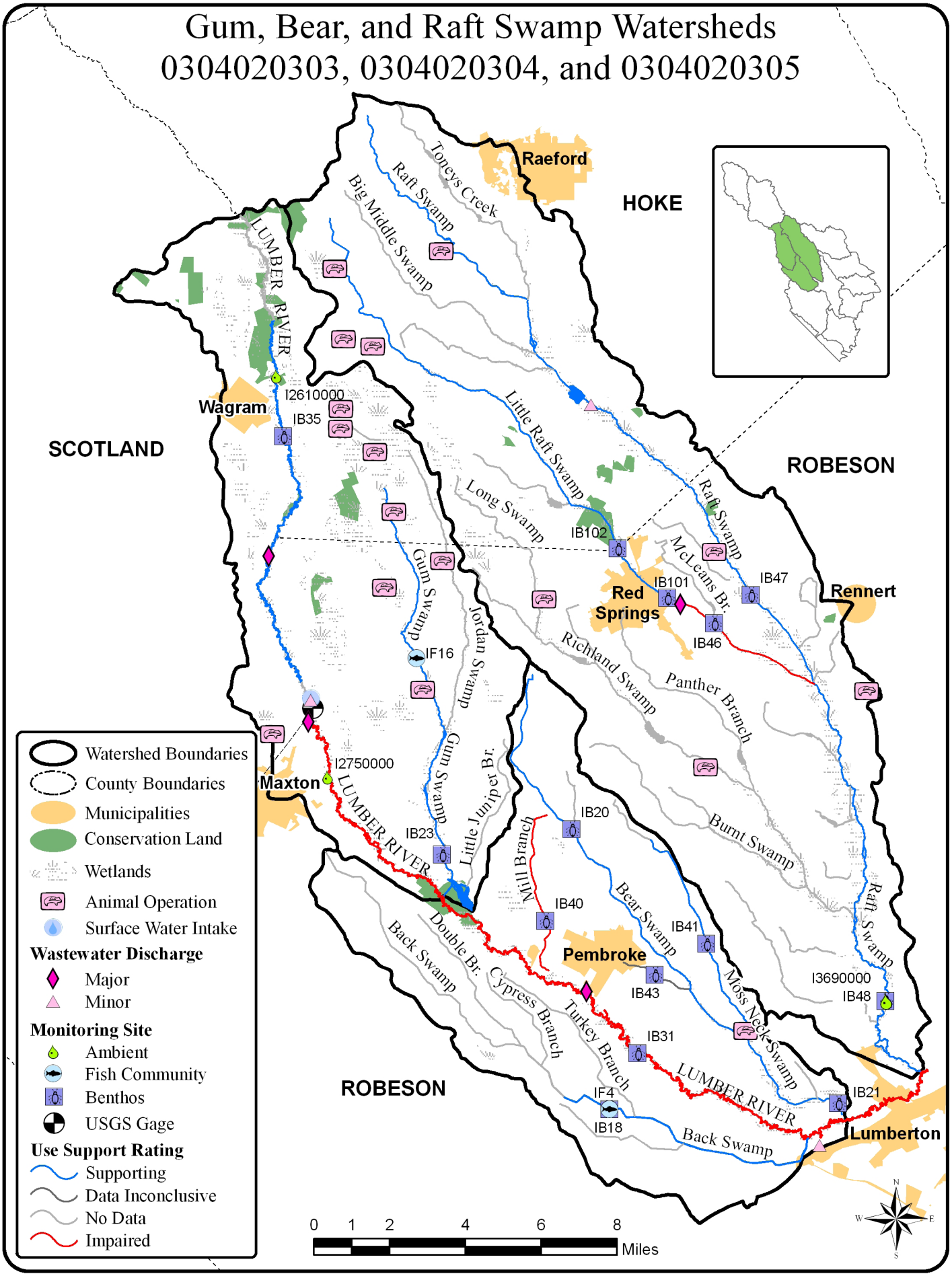
Town of Wagram-Lumber River (030402030301)
This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203020010) based on lack of stream buffers and the presence of endangered species. About 28 square miles of the watershed are classified as a Water Supply IV watershed because the former raw water intake for Robeson County is located in this subwatershed on the Lumber River AU # 14-(4). This water supply intake is currently not in use because several groundwater wells were installed to replace it but all classifications will remain in place to protect it for future use.

Benthic macroinvertebrate sampling site IB35, located at State Road 1404 on the Lumber River AU # 14-(3), was sampled during the 2006 field season. A high number of intolerant taxa, as well as, a high overall number of specimens were collected. This site received an excellent bioclassification rating continuing a perfect record of excellent ratings since collection began here in 1985. The habitat score given for this location was a 90 out of 100.

Gum Swamp (030402030302)
This subwatershed is designated as a Targeted Local Watershed (03040203040010) by the Ecosystem Enhancement Program in 2003. It was chosen because of its 125 miles of streams only 30 percent had adequate buffers.

Benthic macroinvertebrate sampling site IB23, located at State Road 1312 on Gum Swamp AU # 14-5, was given a Natural bioclassification rating due to the presence of a high number of intolerant taxa in both 2001 and 2006. The bottom substrate and pool variety here was rated lower than many of the streams in the sandhills resulting in a lower habitat score of 76 out of 100.

FIGURE 2-5: GUM, BEAR, AND RAFT SWAMP WATERSHEDS (0304020303, 0304020304, AND 0304020305)



Town of Maxton-Lumber River (030402030303)
This subwatershed contains northeastern Maxton and is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203020010). Although, the Robeson County water intake is currently not in use, much of this subwatershed is classified as a Water Supply IV watershed. Conductivity at ambient monitoring site I2750000, on the Lumber River AU# 12-(4.5), ranged from 36 to 1371 umhos/cm with a median of 121 umhos/cm. However, conductivity was only high during the drought of 2002 and returned to normal after the drought ended.

Bear Swamp-Lumber River (0304020304)

This watershed has three subwatersheds. This entire watershed is now designated as a Targeted Local Watershed by the Ecosystem Enhancement Program with the addition of Mill Branch and Bear Swamp-Lumber River as TLWs in 2008. In February of 2006, EEP published a local watershed management plan for Mill Branch and Bear Swamp-Lumber River watersheds. This local watershed management plan identifies the type, cause, and location of problems, as well as, prioritizes specifically what needs to be done and where. This plan can be found at: ***http://www.nceep.net/services/lwps/Bear_Swamp/Lumber_River_Watershed_Management_Plan.pdf*** .

There is one permitted discharger with a maximum daily flow of 1.33 MGD that belongs to the Town of Pembroke WWTP (Figure 2-5). The Pembroke WWTP received a CWMTF grant in 2007 for upgrades to the facility. The town of Pembroke also received a second CWMTF grant in 2007 to connect Union Chapel Elementary School to the treatment plant thus eliminating a troubled septic system.

Back Swamp (030402030401)
Benthic macroinvertebrate sampling site IB18, located at State Road 1003 on Back Swamp AU# 14-8-(2.5), has been evaluated four times; twice in 2001 and twice in 2006. This site was Not Rated for both of the samples taken in 2001. The first sample taken in 2006 was done in February using swamp criteria and the second was done in July using flowing stream criteria. It rated Natural in February but only received a Good-Fair rating in July when streams classified as swamp waters are usually not evaluated. The total number of specimens collected here has decreased but the amount of intolerant taxa has remained stable. While there is a stormwater drain near the site it is not thought to be the cause of the population decline. The main reason for the decline in this area is believed to be from channel modification, poor bottom substrate, and the lack of pool variety. These characteristics led to a habitat score of 64 out of 100.

Fish Community Sampling site IF4, located at the same location as IB18, has shown an increase in the total number of fish collected between 1991 and 2001. The number of pollution intolerant fish species has remained fairly stable throughout the same time period. This site was not sampled for fish during the assessment period.

Bear Swamp-Lumber River (030402030402)
Moss Neck Swamp AU# 14-9-3-(2), at State Road 1570, Bear Swamp AU# 14-9-(0.5) at NC 710, and Watering Hole Swamp AU# 14-9-2 were assessed in 2004 as part of the EEP study. Moss Neck and Bear Swamp both received a Good-Fair rating but Watering Hole Swamp was Not Rated because the drainage area is too small. EEP's local watershed plan evaluated this subwatershed and characterized most of the subwatershed as a critical area having low functioning hydrology. The main causes leading to this loss of function are lack of riparian buffers, channelization, ditching of wetlands, and conversion of agricultural land to residential/commercial uses.

Benthic macroinvertebrate sampling site IB21, located at State Road 1339 on Bear Swamp AU# 14-9-(1.5), was given a Moderate bioclassification rating despite receiving the lowest habitat score in the entire basin during the assessment period, 52 out of 100.

Mill Branch-Lumber River (030402030403)
This subwatershed is part of Ecosystem Enhancement Program's Targeted Local Watershed (03040203030010). Benthic macroinvertebrate sampling site IB40, located at NC 710 on Mill Branch AU# 14-6, was evaluated by the Biological Assessment Unit in March of 2004 as part of the development of an EEP watershed management plan and was rated Fair. The EEP watershed management plan reported elevated levels of Nitrate-Nitrite in Mill Branch attributed to agricultural runoff. This assessment unit is currently impaired for aquatic life and appears of the draft 303(d) list.

Benthic macroinvertebrate sampling site IB31, located on the Lumber River along AU # 14-(7), was sampled during the 2006 field season. A high number of intolerant taxa, as well as, a high overall number of specimens were collected. This site received its tenth Excellent bioclassification rating since 1983. The habitat score given for this location was a 88 out of 100.

Raft Swamp (0304020305)

The Town of Red Springs and the western part of Raeford are the only municipalities in this watershed (Figure 2-5). The Red Springs WWTP and the Antioch Water Treatment Plant (WTP) are the only permitted wastewater dischargers in the watershed with a combined maximum daily flow of 2.5 MGD. There are 8 permitted animal operations in the watershed. There are five subwatershed in this watershed.

Upper Raft Swamp (030402030501)
Upper Raft Swamp subwatershed is part of EEP's Targeted Local Watershed (03040203060020) and also contains western Raeford. In early 2006, an animal operation was fined $11,529.36 for discharging swine waste to an Unnamed Tributary of Big Middle Swamp AU # 14-10-1.5.

Little Raft Swamp (030402030502)
The Red Springs WWTP, which discharges to Little Raft Swamp AU# 14-10-5b, has had numerous standards violations for a multitude of parameters including chlorine, copper, cyanide, fecal coliform bacteria, mercury, nitrogen, and total suspended solids. These violations have contributed greatly to a dramatic decline in water quality which is very apparent in the benthos data collected during the assessment period. The Town of Red Springs has been working to correct these issues by making upgrades to the treatment plant and collection system. In 2008, mercury traps were installed at the town dentist office and the lateral line leading to the building was replaced. An equalization basin was added to the treatment plant in February 2009. The town is continuing to make further upgrades and replacements at the treatment plant to improve its operation.

Benthic macroinvertebrate sampling site IB102 located, at State Road 1323 on Little Raft Swamp AU# 14-10-5a, just over two miles upstream of the Red Spring WWTP, was sampled in 2006. This sample yielded more specimens and 16 intolerant species, far more than the downstream station IB46. In addition to the intolerant species, there were 5 species found here and nowhere else in the Lumber Basin. This site was rated Natural.

Benthic macroinvertebrate sampling site IB46, located at State Road 1505 on Little Raft Swamp AU# 14-10-5b, is approximately one mile downstream from the Red Springs WWTP outfall. A 2001 study of benthic sampling site IB46 and IB101, located less than one-half of a mile upstream from the discharger, found no difference between the two sites. Samples from site IB46 changed dramatically between 2001 and 2006 with a decrease in the number of specimens collected. The overall diversity of species decreased especially among the pollution sensitive species, which decreased from nine in 2001 to three for the latest assessment. The decline in biological health of Little Raft Swamp AU# 14-10-5b resulted in a Severe bioclassification and it was placed on the draft 2008 303(d) list.

Little Raft Swamp subwatershed is part of the EEP's Targeted Local Watershed (03040203060020).

Richland Swamp (030402030503)
There has not been any data collected by DWQ in the Richland Swamp watershed since two benthic macroinvertebrate stations were assessed in 1991. The data collected proved to be inconclusive and they were assigned a rating of Not Rated.

Middle Raft Swamp (030402030504)
Middle Raft Swamp subwatershed is part of the EEP's Targeted Local Watershed (03040203060020). This subwatershed has four waterbodies that are supplementally classified as Unique Wetlands because they posess exceptional state or national ecological significance. They are Antioch Bay, Hamby's Bay, and two Bays known as Oak Savanna. All of these areas are properties owned by The Nature Conservancy.

Benthic macroinvertebrate sampling site IB47, located at State Road 1505 on Raft Swamp AU# 14-10-(1), was rated Natural in 2006. There was little change in the habitat or benthic organisms at this location between assessments.

Lower Raft Swamp (030402030505)
Lower Raft Swamp subwatershed is the EPP's Targeted Local Watershed (03040203060030). All waterbodies within this subwatershed are classified as WS-IV and therefore require stream buffers to protect the City of Lumberton's water supply.

Benthic macroinvertebrate sampling site IB48, located at State Road 1527 on Raft Swamp AU# 14-10-(5.5), was evaluated for the first time during the 2006 assessment. This station was added because all upstream drainage in the entire Raft Swamp watershed flows through this point so it can be used to assess cumulative effects. This station received a habitat score of 79 out of 100, only 1 point lower than the upstream station IB47. IB48 was rated Moderate because it had a lower number and fewer types of organisms. Red Springs WWTP on Little Raft Swamp, which is about 15 miles upstream from this site, may still be impacting water quality in Raft Swamp. However, other causes such as impacts from nearby animal operations can not be ruled out completely.

Gallberry Swamp (0304020306)
This watershed contains the municipalities of Lumber Bridge, Parkton, Saint Pauls, and part of Rennett (Figure 2-6). There are 3 minor NPDES wastewater dischargers with a total permitted flow of 0.7 MGD and 7 animal operation permits. This watershed has five subwatersheds. All assessed streams are supporting their uses.

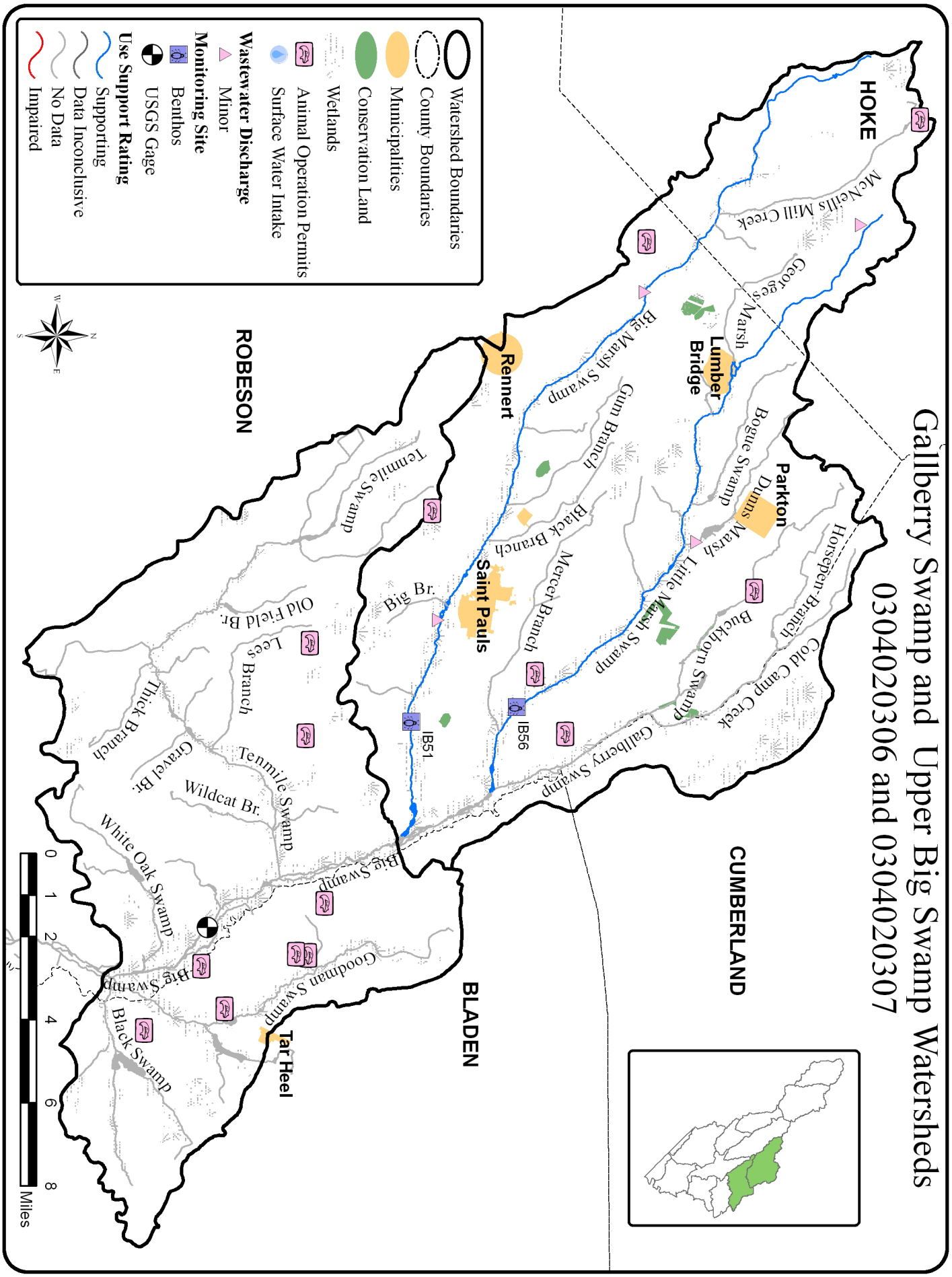
Upper Little Marsh Swamp (030402030601)
The Parkton WWTP discharges to Dunns Marsh AU # 14-22-1-3-2 just before it reaches Little Marsh Swamp AU# 14-22-1-3. Dunns Marsh is currently not monitored but Little Marsh Swamp is rated Supporting.

Lower Little Marsh Swamp (030402030602)
Benthic macroinvertebrate sampling site IB56, at State Road 1907 on Little Marsh Swamp AU# 14-22-1-3, had results in 2006 similar to samples taken in 2001 with only a slight reduction in the types of intolerant species. The overall number of specimens collected did not change at all, so this site's bioclassification of Natural remains.

Upper Big Marsh Swamp (030402030603)
Goose Pond Bay, which is owned by The Nature Conservancy, is located in this subwatershed and is supplementally classified as a Unique Wetland.

Lower Big Marsh Swamp (030402030604)
Dunahoe Bay and Pretty Pond Bay, which are owned by The Nature Conservancy, are both located in this subwatershed and are supplementally classified as a Unique Wetland. These are both clay-based carolina bays that rely solely on rainfall as a source for water. Dunahoe Bay serves as a nesting location for Cattle Egrets and Anhingas.

FIGURE 2-6: GALLBERRY AND UPPER BIG SWAMP WATERSHEDS (0304020306 AND 0304020307)



Benthic macroinvertebrate sampling site IB51, located at State Road 1924 on Big Marsh Swamp AU # 14-22-2, was sampled and evaluated as Natural. This site had many intolerant taxa and an increase in the overall number of specimens collected.

Big Branch AU # 14-22-2-4 has been selected as a random ambient monitoring site for the 2009-2010 cycle. The 1.8 mile stream, which drains to Big Marsh Swamp, will be tested for a wide range of parameters during this two year period. Big Branch empties to Big Marsh Swamp about a half a mile upstream of sampling site IB51.

Gallberry Swamp (030402030605)
Most of this subwatershed is part of the EEP Targeted Local Watershed (03040203110010). This subwatershed has the potential to grow rapidly because its proximity to Fayetteville. The Fayetteville area is expected to experience rapid growth over the next few years due to an expansion of activities associated with Fort Bragg Military Base. I-295 is a road that is planned for construction and will run in between Fayetteville and Fort Bragg. The I-295 outer loop is planned to meet I-95 proper in this subwatershed.

Upper Big Swamp (0304020307)

The Town of Tarheel is partially located in this watershed (Figure 2-6). There are no permitted wastewater discharges in the watershed and it is made up of five subwatersheds. The world's largest swine processing facility is located in this watershed which makes southeastern North Carolina a desirable location for swine farms.

No samples were collected in *Upper Tenmile Swamp subwatershed (030402030701).*

Lower Tenmile Swamp (030402030702)
In July 2007, DWQ responded to a complaint about an illicit discharge from a confined animal feeding operation. Upon inspection, DWQ found evidence of a past discharge that had adverse impacts to surface waters. The animal operation permit holder was fined $3,948.49 for a non-permitted discharge of swine waste to Lees Branch AU# 14-22-3-9 and failure to report such a discharge.

No no samples were collected in *Goodman Swamp subwatershed (030402030703), Bryan Millpond-Black Swamp subwatershed (030402030704),* or *Lewis Mill Branch-Big Swamp subwatershed (030402030805).*

Middle Big Swamp (0304020308)

Middle Big Swamp watershed, with 20 animal operation permits, has the highest concentration of animal operation permits of all 10-digit watersheds in the entire Lumber Basin, at one for about every 4.25 square miles. (Figure 2-7). This watershed is made up of only two subwatersheds.

No samples were collected in *Crawley Swamp subwatershed(030402030801).*

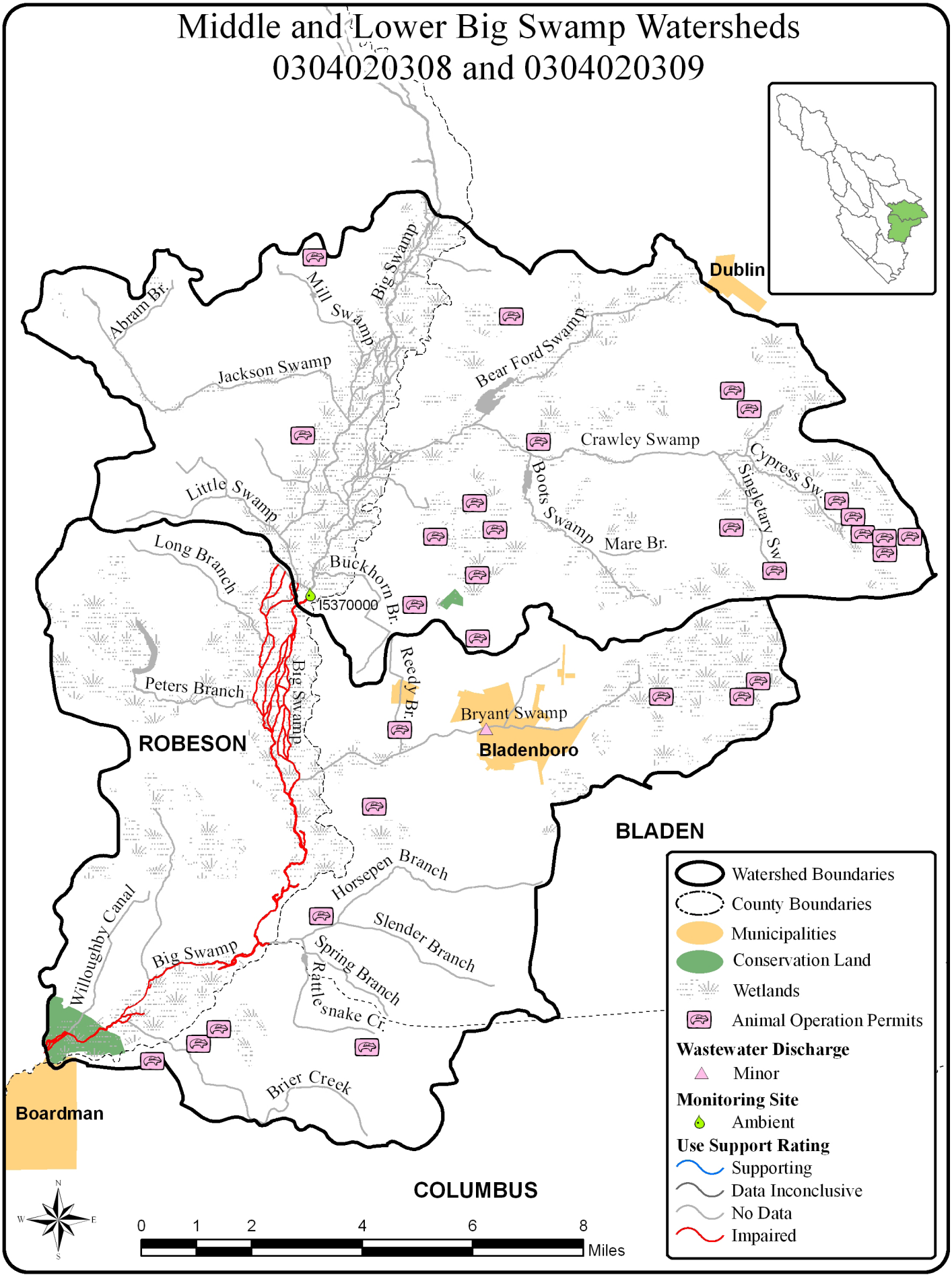
Jackson Swamp-Big Swamp (030402030802)
Samples taken at ambient monitoring site I5370000, on Big Swamp at NC Highway 211, do not show any signs of being impacted by the many swine operations in the watershed.

Lower Big Swamp (0304020309)

The town of Bladenboro is located in this watershed and operates the only permitted discharger the Bladenboro WWTP (Figure 2-7). This watershed has four subwatersheds.

Bryant Swamp (030402030901)
In 2006, the Town of Bladenboro received a grant from the CWMTF to conduct an inflow and infiltration study of their sewer collection system. The results of this study determined that lines and manholes need to be replaced and at an estimated cost of over 1.2 million dollars.

Figure 2-7: Middle and Lower Big Swamp Watersheds (0304020308 and 0304020309)



No samples were collected in *Peters Branch-Big Swamp subwatershed (030402030902)* or *Horsepen Branch subwatershed (030402030903).*

Brier Creek-Big Swamp (030402031004)
In 2008 and 2009, the planning and construction phases of the Ecosystem Enhancement Program's Columbus Swamp Project were completed. This project restored 33.5 acres of wetland and enhanced another 2.5 acres of wetland along Brier Creek AU # 14-22-17. This project is now in the monitoring phase and will be monitored for five years to ensure that the restoration was successful.

Saddletree Swamp-Lumber River (0304020310)

This watershed contains almost all of the City of Lumberton and 5 NPDES discharge permits (Figure 2-8). There are 2 major and 3 minor NPDES discharge permits with a total maximum daily flow of 22.56 MGD. This watershed has six subwatersheds.

Saddletree Swamp (030402031001)
Part of this subwatershed is the Ecosystem Enhancement Program's Targeted Local Watershed (03040203080020). This part of the subwatershed which is mainly east of Interstate 95 contains much of northern Lumberton. It was selected as a TLW because this part of the watershed was determined to have approximately 11 percent impervious cover and 63 percent of the streams lacked buffers.

Jacob Swamp (030402031002)
Benthic macroinvertebrate sampling site IB25, located at NC 41 on AU # 14-(13)a of the Lumber River within the municipality of Lumberton, was assessed in 2006. This was the third time that this site has been assessed since 1996 and it has received an Excellent rating every time. Due to the presence of pollution sensitive species and the overall number of species, this site was awarded an Excellent rating despite a low habitat score of 66 out of 100. Although this site has a low habitat score, macroinvertebrates are thriving where the habitat is suitable for colonization due to excellent upstream water quality.

Benthic macroinvertebrate sampling site IB27, located on the Lumber River AU# 14-(13)d, is downstream from benthic macroinvertebrate station IB25. It is at this point that the river becomes slower and deeper. This station differed from the downtown Lumberton station (IB25) in that it had a higher percentage of species tolerant to pollution and a higher habitat score of 77 out of 100. Comparing this assessment period to previous assessments, water quality appears to be holding steady here with a Good-Fair rating but is at risk for impairment.

No samples were collected in *Jacob Swamp-Lumber River subwatershed (030402031003)* or *Tenmile Branch-Mill Swamp subwatershed (030402031004).*

River Swamp-Lumber River (030402031105)
Conductivity at ambient monitoring site I4650000, on the Lumber River, ranged from 57 to 1157 umhos/cm with a median of 142 umhos/cm. However, the high values occurred during the drought of 2002 and returned to normal when the drought ended. Conductivity at Ambient monitoring site I5690000, ranged from 65 to 1214 umhos/cm with a median of 126 umhos/cm but also returned to normal after the drought.

Porter Swamp (0304020311)

The municipalities that are completely or partially in this watershed include Chadbourn, Cerro Gordo, Boardman, Orrum, and Fair Bluff (Figure 2-9). It also contains the NCDOT mitigation site known as Bush Island and much of the Lumber River State Park. The recently constructed Fairmont Regional WWTP discharges to the Lumber River in this watershed with a permitted maximum daily flow of 1.75 MGD. There are 8 permitted animal operations located here.

FIGURE 2-8: SADDLETREE SWAMP-LUMBER RIVER WATERSHED (0304020310)

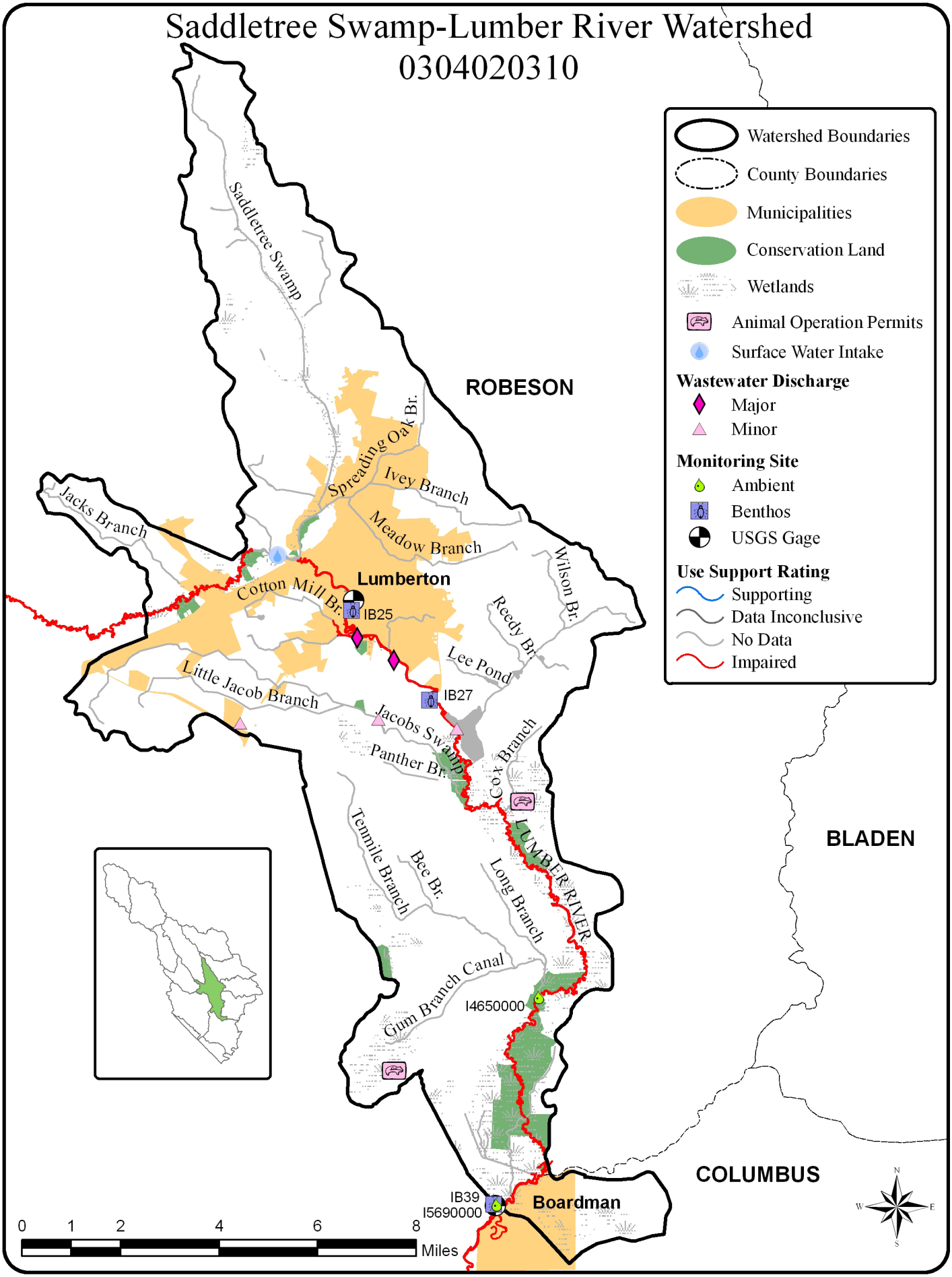
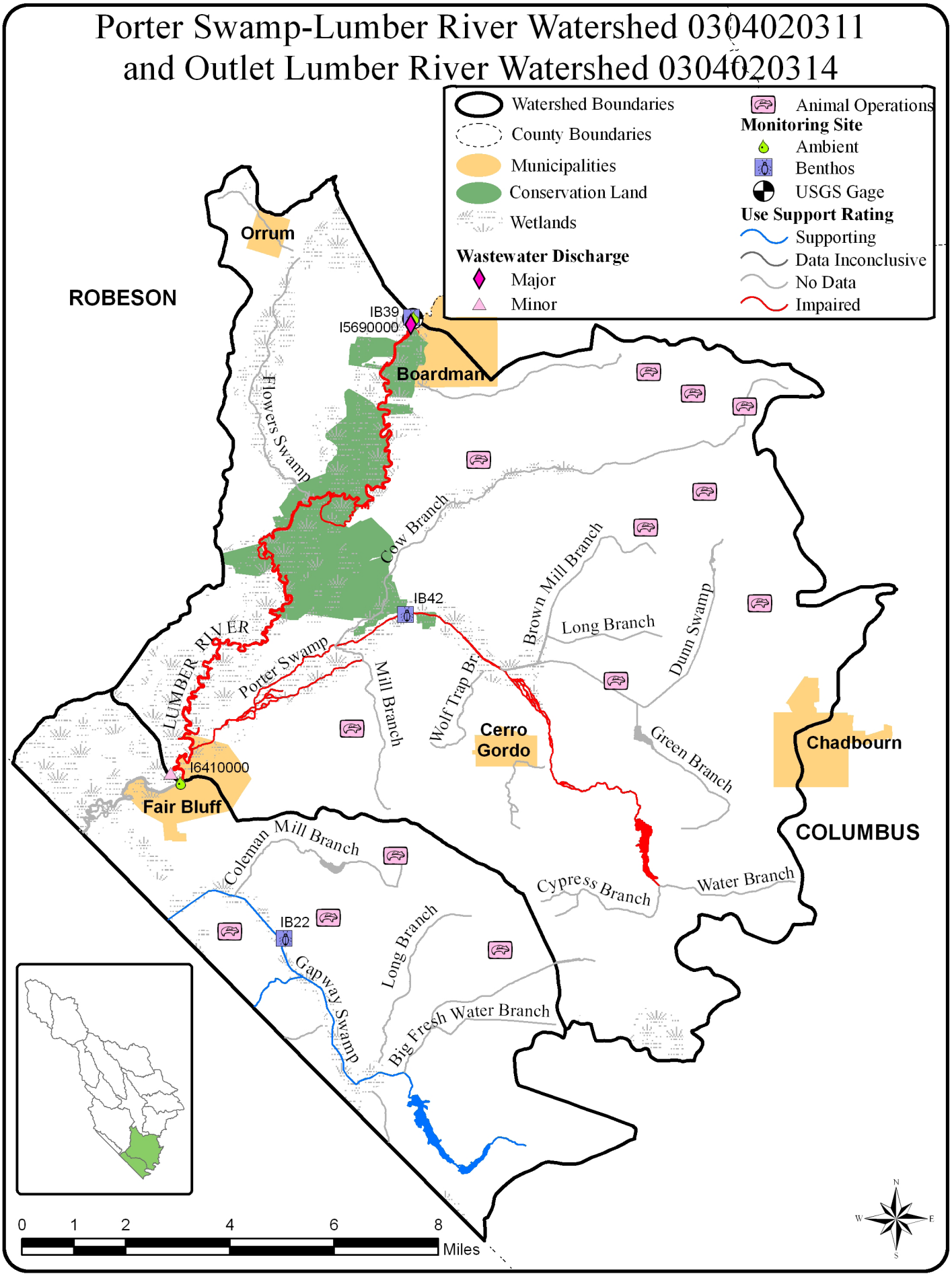


FIGURE 2-9: PORTER SWAMP-LUMBER RIVER AND OUTLET LUMBER RIVER WATERSHEDS (0304020311 AND 0304020314)



Dunn Swamp (030402031101)
This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203191010). It was chosen because it is part of the larger Porter Swamp watershed and Porter Swamp watershed downstream has a biological impairment downstream of Dunn Swamp.

Upper Porter Swamp (030402031102)
This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203191010). It was chosen because of a biological impairment in the subwatershed. Porter Swamp AU# 14-27 was placed on the draft 2008 303(d) list for ecological and biological integrity as a result of the benthic macroinvertebrate sample taken at site IB42 located at State Road 1503. It was noted that at the time of sampling there was a higher than normal rate of flow that made sampling difficult. Additional sampling will assist with verifying this rating. Porter Swamp has been impaired for mercury since 1998 but was not on the 303(d) list because there is an approved ***TMDL for mercury***.

Lower Porter Swamp (030402031103)
This subwatershed makes up the majority of the Ecosystem Enhancement Program's Targeted Local Watershed (03040204190010).

Benthic macroinvertebrate sampling site IB42, located at State Road 1503 on Porter Swamp AU# 14-27, has declined in the overall number of specimens and intolerant taxa. In 1996 and 2001, it was reported that there were six different types of intolerant taxa at the Porter Swamp site but there was only one present in 2006. Some of the declines may be due to high flow conditions during sampling. Regardless, the site received a bioclassification rating of Severe, thus making it impaired for aquatic life. Porter Swamp AU# 14-27 was placed on the draft 2008 303(d) list. This area is mostly rural and there are no discharge permits. High flows or nonpoint source pollution may be the cause of this decline.

Flowers Swamp-Lumber River (030402031104)
The part of this subwatershed to the west of the Lumber River is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203190010).

Benthic macroinvertebrate sampling site IB39, located at Highway 74 on the Lumber River AU # 14-(13)f, is reflective of water quality flowing into the watershed. There was an absence of stoneflies and a reduction of mayflies in the 2006 samples, but this was attributed to high flow at the time of sampling. Although the bioclassification rating dropped from an Excellent rating in 2001 to a Good rating in 2006, it was determined that water quality at this location is stable since it was given a Good rating for 3 samples prior to 2001.

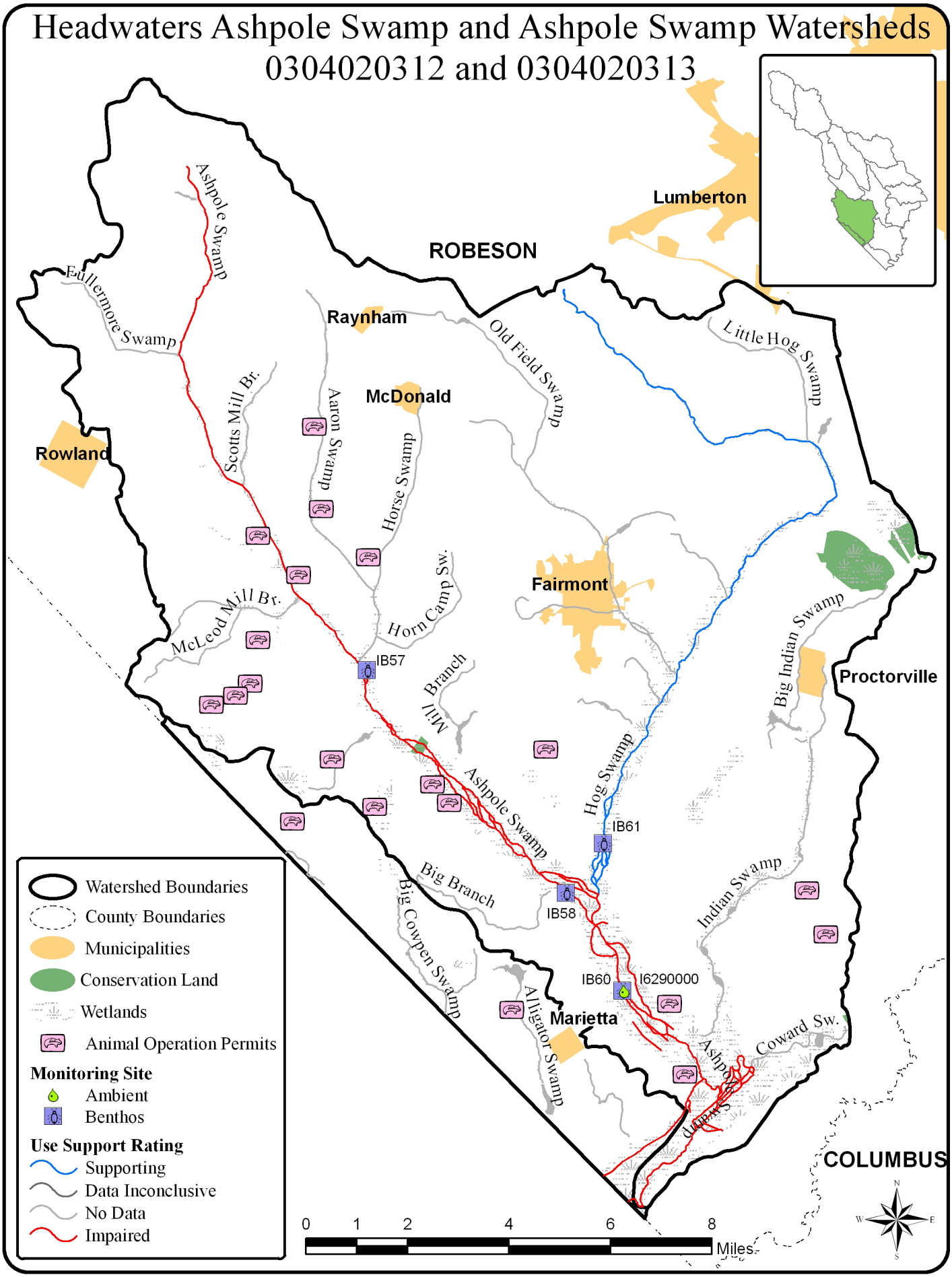
Ambient monitoring site IB6410000 did not exceed any water quality parameters in more than 10 percent of the samples taken and had lower conductivity than the upstream ambient station I5690000.

Ashpole Swamp Headwaters (0304020312)

Municipalities in this watershed include Proctorville, McDonald, Raynham, and Fairmount (Figure 2-10). There are no NPDES discharge permits here but there are 18 permitted animal operations. Ashpole Swamp AU # 14-30 a & b are considered by the Natural Heritage Program to posses significant aquatic habitats. Colonial wading bird colonies and Rotund Mysterysnails have been reported to inhabit Ashpole Swamp.

Horse Swamp (030402031201)
No samples were collected in this subwatershed. Benthic macroinvertebrate sampling site IB57 is located just after Horse Swamp empties into Ashpole Swamp AU # 14-30a and is the best available indicator of water quality in this subwatershed.

Figure 2-10: Headwaters Ashpole Swamp and Ashpole Swamp Watersheds (0304020312 and 0304020313)



Ashpole Swamp Headwaters (030402031202)
Benthic macroinvertebrate sampling site IB57, located at NC Highway 130 on Ashpole Swamp AU# 14-30a, was sampled for the first time in 2006. It was rated Moderate although it has good habitat characteristics and contained a good diversity of taxa including pollution sensitive taxa.

Town of Fairmont-Old Field Swamp (030402031203)
This subwatershed completely contains the municipality of Fairmont. Stormwater runoff from Fairmont eventually ends up in Old Field Swamp AU# 14-30-7-4 which empties in Hog Swamp AU# 14-30-7-1. DWQ has not collected any water quality data from this subwatershed so impacts can only be assessed by data collected in Hog Swamp.

Hog Swamp (030402031204)
Samples taken from benthic macroinvertebrate sampling site IB61, located at State Road 2262 on Hog Swamp AU# 14-30-7-1, indicate that water quality has decreased in Hog Swamp. The site rated Natural in 1996 and 2001 but fell to Moderate in 2006 because there was a decrease in pollution sensitive organisms. Despite the decrease in intolerant taxa, it is Moderate because the overall number of specimens collected increased from previous samples. The type of taxa found and not found suggest that low dissolved oxygen levels and organic enrichment may be the cause of the change in species composition at the site.

No samples were collected in *Mill Branch-Ashpole Swamp subwatershed (030402031205).*

Benthic macroinvertebrate sampling site IB58, located at NC Highway 41 on Ashpole Swamp AU# 14-30a just prior to the confluence with Hog Swamp AU# 14-30-7, was sampled twice in 2006. This site was rated Natural in 1996 and 2001 but showed a slight decrease in both intolerant taxa and overall population of organisms which resulted in a Moderate rating in 2006. This decline may be the result of high flow rates at the time of sampling. This segment of Ashpole Swamp appears to be healthy and has a broad floodplain with adequate buffers.

Indian Swamp (030402031206)
In 2006, NC DOT restored wetland hydrology to Juniper Bay, a 728.5 acre former carolina bay located in headwaters of this watershed just north of Proctorville. EEP is currently managing the monitoring of this reconstructed wetland that drains to Big Indian Swamp AU # 14-30-8-1.

Coward Swamp-Ashpole Swamp (030402031207)
Ashpole Swamp AU # 14-30b, at ambient monitoring site I6290000, exceeded the iron standard in 64.7 percent of the samples. This is natural and does not pose a threat to water quality.

Ashpole Swamp (0304020313)
This Watershed is mainly in South Carolina but a small portion, which contains the municipality of Marietta, is in North Carolina (Figure 2-10). It has no permitted discharges and only two animal operation permits. Ashpole Swamp AU# 14-30b is the only assessed waterbody in the watershed and is supporting for aquatic life and recreation but is impaired for fish consumption due to mercury levels in fish tissue. There are two subwatersheds in this watershed. They are *Cowpen Swamp-Bear Swamp (030402031302)* and *Ashpole Swamp (030402031403).*

Lumber River Outlet (0304020314)
This watershed contains southern Fair Bluff and the town's WWTP which has a permitted daily maximum flow of 0.23 MGD (Figure 2-9). There are also 4 animal operation permits. This watershed has part of 3 subwatersheds.

Table 2-2: CWMTF Grants Funded for Fiscal Years 1997 - 2007 in the Lumber Subbasin*

Project ID	Applicant	Purpose	Amount Funded	Total Cost
1997A-108	NC Div. of Parks and Recreation	Buffer Acquisition	$400,000	$900,000
1997A-118	Town of Fairmount	Wastewater	$1,000,000	$6,965,700
1997B-002	NC Div. of Parks and Recreation	Buffer Acquisition	$550,000	$1,750,000
1997B-611	Town of Wagram	Wastewater	$400,000	$2,647,850
1998A-203	Sand Hills Area Land Trust	Buffer Acquistion	$96,000	$3,097,000
1998A-602	Town of Pembroke	Wastewater	$380,000	$1,200,000
1998B-511	City of Lumberton	Wastewater	$1,000,000	$4,000,000
1999B-015	Sand Hills Area Land Trust	Buffer Acquisition	$31,250	$35,000
1999B-509	City of Lumberton	Wastewater	$692,000	$2,112,617
1999B-510	Town of Parkton	Wastewater	$670,000	$705,700
1999B-515	Town of Saint Pauls	Wastewater	$95,000	$95,000
2001A-027	Sand Hills Area Land Trust	Buffer Acquisition	$389,000	$402,000
2001A-506	Town of Red Springs	Wastewater	$351,000	$924,000
2001A-509	Town of Saint Pauls	Wastewater	$296,000	$369,700
2001B-013	City of Lumberton	Buffer Acquisition	$69,000	$369,941
2001B-047	Sand Hills Area Land Trust	Buffer Acquisition	$40,000	$157,500
2001B-501	Town of Bladenboro	Wastewater	$1,863,000	$2,327,976
2002A-027	Sand Hills Area Land Trust	Buffer Acquisition	$44,000	$102,000
2003D-009	Lumber River Conservancy	Minigrant Donated	$9,200	$36,200
2003D-011	Lumber River Conservancy	Minigrant Donated	$15,350	$229,850
2004A-005	Town of Fair Bluff	Buffer Acquisition	$91,000	$222,060
2004A-009	City of Lumberton	Buffer Acquisition	$100,000	$192,212
2004A-502	Town of Fair Bluff	Wastewater	$2,063,000	$1,328,100
2004D-019	Lumber River Conservancy	Minigrant Donated	$5,000	$5,000
2004M-004	Lumber River Conservancy	Minigrant Standard	$25,000	$31,250
2005A-018	NC Div. of Parks and Recreation	Buffer Acquisition	$2,000,000	$4,698,600
2005A-807	Robeson County	Planning	$238,000	$303,000
2005D-018	Lumber River Conservancy	Minigrant Donated	$4,000	$3,800
2005B-019	Lumber River Conservancy	Buffer Acquisition	$188,000	$188,000
2005B-020	Lumber River Conservancy	Buffer Acquisition	$73,000	$153,000
2005B-021	Lumber River Conservancy	Buffer Acquisition	$400,000	$406,800
2005B-706	Robeson County	Stormwater	$1,195,000	$2,399,450
2006A524	Town of Red Springs	Wastewater	$1,850,000	$4,571,000
2006A-604	City of Lumberton	Wastewater	$246,000	$410,800
2006B-030	Sand Hills Area Land Trust	Bufer Acquisition	$153,000	$208,437
2006S-009	Town of Aberdeen	Minigrant Stormwater	$50,000	$68,000
2006B-802	Town of Bladenboro	Planning	$40,000	$44,500
2007-530	Town of Pembroke	Wastewater	$79,000	$1,275,400
2007-615	Town of Pembroke	Wastewater	$20,000	$464,600
2007-801	Town of Aberdeen	Planning	$40,000	$55,000
Total	--	--	$17,210,840	$46,857,043

*Does not include statewide or regional grants.

Headwaters Gapway Swamp (030402031401)
Benthic macroinvertebrate sampling site IB22, located at State Road 1356 on Gapway Swamp AU# 14-31, was assessed for the third time in 2006. Over the past ten years intolerant taxa have been steadily declining; however, their numbers have not yet decreased enough to warrant a change in the bioclassification of Moderate. At this time, there is not enough information to determine the cause of this steady decline. If this site worsens during the next assessment period, it will most likely result in the impairment of Gapway Swamp. Gapway Swamp has been highly channelized and lacks buffers at some locations.

No samples were collected in *Hook Branch subwatershed (030402031403)* or *Lumber River subwatershed (030402040804).*

Incentive Programs

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. A list of CWMTF Grants that have been funded through 2007 is provided in Table 2-2 on the preceding page.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Table 2-3: BMP Installed through NCACSP between 2002 and 2006

BMP Implemented	Amount	Units	Cost
Conservation Tillage (3 years)	6269	Acres	$383,456
Long Term No-Till	394	Acres	$49,186
Cropland Conversion - Grass	883	Acres	$194,661
Cropland Conversion - Trees	475	Acres	$58,790
Stripcropping	9	Acres	$1,227
Grassed Waterway	0.2	Acres	$282
Field Border	121	Acres	$25,840
Filter Strip	3	Units	$982
Water Control Structure	5	Units	$14,535
Grade Stabilization	1	Units	$12,367
Livestock Exclusion	3250	Feet	$2,194
Dry Stack	2	Units	$40,602
Incinerater	20	Units	$112,354
Closure - Waste Impoundments	1	Units	$958
Waste Application Equipment	7	Units	$44,955
Total	--	--	$942,389

Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 2-3 shows the number of projects implemented in the Lumber River subbasin and the dollar amount invested. Table 2-4 shows the water quality benefits realized from that investment.

Table 2-4: Benefits Resulting from BMPs Installed through NCACSP between 2002 and 2006

Benefits	Amount	Units
Acres Affected	11,736	Acres
Soil Saved	33,462	Tons
Nitrogen Saved	307,462	Pounds
Phosphorous Saved	26,019	Pounds
Waste - Nitrogen Managed	1,017,568	Pounds
Waste - Phosphorus Managed	1,082,371	Pounds

Recommendations

Mill Branch AU # 14-6 and Porter Swamp AU # 14-27 are both impaired for biological and ecological integrity due to habitat degradation resulting partly from nonpoint source pollution. Water quality in these streams may be improved by buffer acquisition and/or stream/wetland restoration. Such projects may be funded through grants such as the CWMTF or the DWQ Nonpoint Source 319(h) Program. Also both of these streams are in an EEP targeted local watershed and, therefore, could be restored through mitigation projects.

Stormwater regulation is essential to preventing pollution from reaching waterbodies. It is more expensive to retrofit developed areas with stormwater controls than to install them during the initial development. It is recommended that local governments consider developing and implementing stormwater management regulations as soon as possible.